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THOMAS-MORSE AIRCRAFT CORPORATION



Thomas-Morse Training 2-Seater
in flight over Ithaca, N. Y.

THOMAS-MORSE AIRCRAFT CORPORATION



Going to Press

The photograph here shows a battery of the special glue presses for joining laminated wood parts. This careful lamination produces a unit infinitely stronger and more enduring than could possibly be shaped from a single piece of wood, while still preserving the important lightness and resiliency which are inherent to wood.

The process calls for the most careful work, the best of materials, and ideal conditions in respect to temperature and humidity of the glue room. Science and experience must be combined to secure an unyielding joint of maximum strength.

It is only one detail in the making of a Glenn L. Martin airplane; but it illustrates again the forethought, experience and care which have placed the Glenn L. Martin planes in a position second to none in America.

THE GLENN L. MARTIN COMPANY
CLEVELAND

Member of the Manufacturers Aircraft Association

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AVIATION

LAMAR L. D'ARCY
EDITOR
VINCENT E. CLARK
EDITORIAL
EDWARD F. WILSON
RALPH H. UNGER
CORRESPONDENT

Vol. XII

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Armored Fighting Airplanes

If the paper on fighting airplanes read by Major Green before the Royal Aeronautical Society, which is reproduced in parts in this issue, the view is expressed that few fundamental changes will occur in this type of machine in the near future; say, within the next ten years. The latest in the opinion of the speaker the principal improvements will consist in better performance and in an increased range of use for the gun, and that the specialized types for high altitude and low altitude work which were developed toward the end of the war will remain the main fighting craft of the air.

As Major Green says, it is very unsafe to predict the development of airplanes. However, it seems to us that the speaker's views on the complete development of the fighting or pursuit airplane are ultra-conservative, for they do not contemplate the possibility of a change in the strategy and tactics of air fighting.

What indeed is the present situation? Drawing on the aerial battle, the pursuit airplane represents the aerial ship of the air, if not in position power, then at least in its speed and function. That is, the pursuit airplane exists for the purpose of enabling one to establish aerial supremacy, or mastery of the air, by sweeping the skies clear of enemy pursuit airplanes and, as a secondary result, of observation and bombing airplanes as well.

Now, the pursuit airplane derives its offensive power from gun power and maneuverability, and not from gun power and position, as the shipbuilder. The protection in the case of the pursuit airplane is entirely a function of its maneuverability, for given two airplanes of equal gun power but unequal maneuverability, the advantage will be with the more maneuverable ship, all other things being equal. But this means that it is in due to the fact that our capabilities of the air are highly vulnerable to gunfire provided it is possible to hit them. The question then arises whether there should not be developed a type of armored pursuit airplane endowed with a good performance, maneuverability, and range, which will be invulnerable to gunfire, or almost so. If such a ship had a performance and range slightly superior to that of observation and bombardment airplanes, and be just capable of outmaneuvering the latter types, there would be means available to an airplane which would actually fill the function of a shipbuilder of the air. Such an armored single motor could be of any kind of military airplane, for, given equal gun power, the superior performance and maneuverability of the delivery power machine would be of little avail against the armor-plated "battle plane," for the latter's superior range would enable it to "shoot the air" while the pursuit plane would be forced down by lack of fuel, if for no other reason.

The development of such an armored battle plane is well within the present engineering possibilities. As a type, the modified metal monoplanes is suggested, for it would permit

of working the armor plating into the structure of the machine and so make it contribute to its strength, while on the other hand the modified monoplanes does away with all those exposed vital parts (struts, wires, etc.) which when damaged may cause the machine to collapse.

We are fully aware that there are some serious objections to the use in warfare of such a machine, or nevertheless believe that the question should be given into detail if for no other reason than the possibility of some other air force building the machine.

Making Air Transport Pay

THE head note on the economics of French air transport enterprises which appears in this issue will be read with interest by all those who for some time have wondered whether the French introduction of air lines was building up, however slowly, a self-supporting business, or whether it merely constituted a hidden provision for a military air reserve and so deflected its several purposes for building air transport.

It is gratifying to learn that the savings realized by the advantages of established air services are beginning to be discovered by actual facts. While it is true that up to last summer the French airports lost money on the passenger carrying business despite the government subsidy, in the six months which followed conditions improved to such an extent that the companies did not lose any money, and some of them made profits. Of course even this very unexpected gain the subsidy, but the improvement is significant enough to warrant careful scrutiny.

The main point about the economics of French air transport is, in our opinion, that the French are endeavoring to build up the most difficult kind of air transport, that of passenger. Passenger, whether carried on land, by sea, or by air, forms the most unremunerative of all transportable items, for the smallest passenger requires, not to speak of safety appliances and the like, taken up on a veritable amount of valuable cargo space. Hence the commercial efficiency of passenger airplanes is, just like that of the palatial ocean liners and of the luxurious express trains, extremely poor, and their operation is correspondingly expensive. It is a fact that even the highest passenger rates charged by steamship lines do not "pay," but merely cover expenses, and it is from freight carrying that the steamship operators derive their profits, most of which are eaten up by the requirements of passenger transport.

These facts deserve to be carefully considered in planning commercial air services. They are fundamentally as sound as the views Mr. Cowie, president of the American Express Co., expressed at the last Annual Executive Conference, when he said that the three "best buys" of air transport are, in the order named, express, mail, and passenger.

The Past Year in Naval Aeronautics

Bureau of Aeronautics - Catapult Launching Gear - Lakehurst
Airdrop Shed - Gallaudet "Multiple Drive" - Aircraft Carriers



These E-1 experimental airplanes shown fitted as a land machine, and later as a seaplane

A review of the year's aeronautical activities presented by the Navy Department sets the following story of achievement:

Bureau of Aeronautics

The outstanding feature of the progress of Naval Aviation during the past year has been the formation of the Bureau of Aeronautics. The centralization of all branches of Naval Aviation heretofore scattered among the various Bureaus of the Navy Department under one head has greatly simplified all matters concerning design, development, construction, operation and care of aircraft and of aviation material—and the design and training of personnel for aviation duties. This has resulted in unity of effort with its attendant economy and the expediting of work. It has also given the Navy a central agency for the formulation and promulgation of Naval air policies and doctrine.

Following this unification of Naval Aeronautics, work has been undertaken or accelerated in many important aviation directions, among which the most essential are the following:

The Catapult Launching Gear

The replacement of the old catapult mechanisms with a form suitable for simplified installation and use aboard battleships and cruisers. This new catapult has somewhat the physical characteristics of a twin torpedo tube, and enables airplanes whether land or sea planes to be launched from vessels without interfering with their movement or gun operations. An aircraft attached to one battleship of the fleet is making her way to launch and make use of any number of planes on the sea boat storage space for. Equipment is now being prepared for other battleships. This device subjected to winds exposed to the true aviation loads such as sea loads should expedite the delivery of aircraft and by at least twenty-four hours.

The practical completion of the Navy's first experimental air has arrived, the Langley. This ship can be employed as

a mobile airframe, thus permitting the use of airplanes with the fleet at any distance from shore. In this connection there has been conducted a series of experiments to develop some new gear for carrier decks.

The production of balloons to such an extent as to make possible the practical demonstration of the use of non-inflatable balloons gas as an airship. (The inflation and flight of the airship U-2, the first airship in the world to fly with balloons gas support).

The completion of the largest airdrop hanger in the world at Lakehurst, N. J.

The adoption and construction of the mooring mast—a device from which airships can be moored in the open, reducing the necessity of entering hangers except for repairs. Mooring masts are being constructed at Lakehurst, N. J., and Pensacola, Fla.

The Lakehurst Airdrop Shed

The completion of experimental problems involved in the construction of the rapid droppable ERI, and beginning construction of the ERI at the Naval Aircraft Factory, Philadelphia, Pa., and at Lakehurst, N. J.

The practical completion of arrangements for the acquisition



The Gallaudet "multiple drive" on which three Liberty's are geared in a single 18 ft. propeller

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The great hanger at the Lakehurst Naval Airship station—the largest of its kind in the world

by the Navy without cost to the United States of a rapid airship to be constructed in Germany.

The development of satisfactory combat planes for the fleet has been undertaken as a problem in connection with defense against aerial attack on the fleet. Several types of high performance combat planes are under development.

Types of torpedo planes have been developed in order to increase the offensive power against enemy fleets.

An amphibious flying boat has been built and successfully tested.

Ship planes for spotting gun fire to enable the fleet to use position for accurate its hitting power at long ranges. New types of the class of planes are under development.

The Gallaudet "Multiple Drive"

The Bureau of Aeronautics' policy of attending to individual improvements in the art has resulted in making available three new varieties engines of superior characteristics, a variable pitch propeller, an 18 ft. propeller shaftless through gear, the power of three Liberty engines, making it the most powerful aircraft propeller in the world, perfection of reduction and reverse gears for Liberty engines, detail improvements in the design of Liberty engines which permits higher compression and at the same time better economy and longer life.

The Fokker Race was won by a Navy plane, showing the world's speed record for a closed course.

The completion and commissioning of the U. S. S. Wright, our first properly equipped fleet tender for lighter and heavier-than-air craft.



The Glenn Martin torpedo plane (2-400 hp. Liberty engines) which is equipped to carry a 1800-lb. regulative torpedo

Participation in the sinking of an German warships by our fleet.

Flight of Naval Air Squadrons accompanying both the Atlantic and Pacific Fleets on cruises to eastern waters according to the Atlantic Coast.

Transoceanic flight of two airplanes commanded by the Marine Corps from Washington, D. C., to Santa Domingo City, D. R., and return.

The completion of approximately two and one-half million miles flown by Naval Aircraft.

Aircraft Carriers

Designs have been completed by the Bureau of Engineering for the conversion of the Langley from a collier to an aircraft carrier and for the conversion of the Wright from an Army transport into an airplane tender.

Plans have been completed for the construction and conversion of two of the battle cruisers which are to be converted in accordance with the terms of the Armament Treaties.

Bureau of Yards and Docks

In the matter of aviation facilities, the Bureau of Yards and Docks has concentrated its efforts on three essential stations maintained under permanent naval policy. Repair stations have been closed, and their equipment for the most part, disposed of. A complete new heavier-than-air station has been developed since May, 1920, in Hawaii. It comprises a large double-roofed hangar offering accommodations for numerous planes, shops, storehouses, quarters, a dispensary,



F-3 naval aircraft seen and shot with the aircraft carrier *Albatross* in the night. The airplanes are of the F5L type.

and all services necessary for efficient operation. This giant has involved an expenditure of \$4,504,906, and is now entering completion.

Many improvements have been carried out at the great hydroelectric station at Laibach, N. J. A concrete dam, designed by the Bureau, has been erected by station owners. To this end the largest dredger may be moved by the work.

The Battle Cruiser-Airplane Carriers

A bill authorizing the conversion of two battle cruisers into airplane carriers was introduced by Congressman Hoots of New York on Feb. 25 in the House and referred to the Committee on Naval affairs. The bill (H.R. 10427) designates as specific vessels for conversion, but a memorial of the legislature of Massachusetts, presented by Mr. Gallagher of Massachusetts, favored having the work of converting the Lexington, now under construction at Quincy, Mass., carried out. This was also referred to the Naval Committee.

The two vessels believed to have been selected are the Lexington, building at the Bethlehem Shipbuilding Corp.'s yard at Fore River, Mass., and the Albatross, building at the New York Shipbuilding Corp. at Camden, N. J. These battle cruisers are the two fastest advanced in construction, the former being 20.3 per cent complete, and the latter 22.2 finished.

According to the terms of the naval treaty the Government may convert two battle cruisers to airplane carriers provided their displacement when converted does not exceed 35,000 tons each. The ships as designed were to be of 45,000 tons displacement, but with the elimination of their armor and ordnance their tonnage will fall within the permitted tonnage, experts believe. Of the total tonnage for airplane carriers allotted to this country, the two ships will amount to 66,000 tons, leaving 48,000 tons to be built if the Langley which is about ready for commissioning is retained, and 66,000 tons if she is discarded. New carriers, except the two converted ships mentioned, cannot exceed 27,000 tons each.

Great Britain, it is said, has seven carriers totaling 87,640 tons, listed as experimental ships they are the Hermes, Eagle, Argus, Furious, Phoenix, Ark Royal and Vindex, but they may all be replaced with 35,000-ton vessels within the limit of 35,000 tons.

Japan has two airplane carriers, the Wakatsuki, 2815 tons, and the Hoshio, building, of 9000 tons. Japan under the treaty also has the privilege of converting two capital ships to carriers to be not over 35,000 tons each. Provided she converts these ships, she may still build one carrier of 35,000 tons.

of five or six men, whereas 200 or more hands are required for maneuvering the same ship into the hangar. As a temporary building device, the mast is unsuitable. It allows the ship to pivot in the wind, and affords adequate protection even in rough weather.

An Albatross is a hydroplan plane and complete power and service systems have also been lately installed.

British Safety Tank Competition

A number of tanks entered into the safety tank competition organized by the British Air Ministry were recently tested at the Royal Aircraft Factory in Farnborough.

The Air Ministry offered prizes amounting to \$20,000 for a tank which will not burst or leak and will be safe from penetration by bullets. Twenty-seven teams have entered, of which six are British, two French, one Japanese, one American and the rest British.

The rules of the competition provide that the tank shall weigh not more than 1½ lb. per gal. Among the other conditions insisted upon are lightness, simplicity, independence to variations of temperature and simplicity of construction.

Incision "crushers" are relatively stated in the tank. Each competing tank, covered in a rough wooden shingle, is attached to a buoy of concrete weighing 600 lb. to represent the engine. The whole contraption is limited to the top of a large lath sheet, about 100 ft. high, then released and allowed to sink on wheels down a red to sink into a bed of sand at the bottom. The tank descends at the rate of about 80 m.p.h. and reaches the bottom with a satisfactory bump.

Three kinds of shock-absorbing tanks have so far been tested. The first, manufactured by Denley, Rams & Morris, consisted of three sheets—an outer one of thin steel with a layer of rubber on the inside, then a steel shell with another layer of rubber, and, finally, the gasoline vessel itself, which is kept in position by shock-absorbing springs.

The second type, the invention of J. Gibson, is made on the bedstead principle, the tank shaped like a barrel, being made in three sections, the sections in front and behind the actual gasoline tank arranged to prevent damage to the gasoline tank itself.

The third tank sent in by the French firm of Bagnon, is made of a rubber paraffin with a sort of armor of thin wire mesh. This tank is covered in rubber shock-absorbers, so that when it strikes it becomes like a ball.

No result will be reported until the tests are finished. Later the tanks will be fired upon by machine-guns at short range to test their capacity to remain gas-tight when penetrated by shell or incendiary bullets.

Explanation of the Roma Picture

Which Shows that the Picture was not Taken the day of the Last Flight, and that the Elevator-Rudler was not out of Alignment



The picture of the Roma which was published in our issue of March 6, with reference lines superimposed, showing that the hull was not out of alignment.

Let me first clarify the picture of the Roma which was published on p. 254 of the March 6, last, issue of Aviation, the following explanation is offered in connection with the accompanying illustration which is identical with that originally published, save for the reference lines, which have been added to it. The morning line, which did not show in the first issue, is drawn along the vertical axis of the original, has also been reproduced.

The lines m , n , r , s , drawn along the vertical edge of the hull, and the lines t , u , drawn along the vertical edge of the funnel, are parallel to one another in this position, and are shown, while here they are inclined owing to the vertical strain of the tripline coil. Their relative positions in the absolute case coincide with that found on a full side view of the ship, except that at the base of the funnel the lines n , r , s and u are vertical, while here they are inclined owing to the strain of the tripline coil. Their relative positions in the absolute case coincide with that found on a full side view of the ship, except that at the base of the funnel the lines n , r , s and u are vertical, while here they are inclined owing to the strain of the tripline coil. Their relative positions in the absolute case coincide with that found on a full side view of the ship, except that at the base of the funnel the lines n , r , s and u are vertical, while here they are inclined owing to the strain of the tripline coil.

The picture was not taken in January, as one takes "death" before the accident, and the picture was not taken at Langley Field on the day of the last flight, but at Bolling Field on Dec. 17, 1923. It was, however, given out by the Information Group, Air Service, after the accident. Although in the newspaper stated that the picture was the elevator inclined at an oblique angle, and so the picture appeared to have been taken on the day of the accident, it was published.

is an interesting illustration. This connection is therefore made as to let those interested have the correct facts concerning the picture.

Speed Trials of Airships

A valued correspondent, who so well served in airship matters, contributes the following remarks to our edition of the March 6 issue, "Lessons from the Roma," in which under point 11 we asked: "Was the ship flying at a safe altitude considering its size and speed?"

Our correspondent says that "this question is especially pertinent in consideration of a report made by the late Major Fitchard, R.A.F., on the subject of the first speed trial of the Roma. In this connection Major Fitchard reported that at an altitude of from 2000 to 2500 ft., when the motor was operating up on the 133, the ship immediately began to beat through a varying altitude of at least 500 ft., and it took some time to steady the ship down, and that it is somewhat liable to change in speed. For this reason he never intended that all future speed trials be carried out at a height of at least 2000 ft."

"In this connection it was probably possible with a ship of the Roma's size for such a condition to occur, and cause the accident without any injury happening to the controls of the ship."

While on this subject, we wish to call attention to the last paragraph of the speed trials of the Portsmouth airship. This ship is reported as the outcome of the Società Remora di Venti di Milano, Italy, builders of the Financiere Remora. This record shows that on its speed trials the ship, which has about one half the capacity of the Roma, and which is a much slower ship, increased its altitude from 650 ft. (low speed) to 2000 ft. for the maximum speed. It will be seen that the Italian photo did not consider it safe to proceed with full speed trials below an altitude of 2000 ft.

Aviation and the Law

American Bar Association and Commissioners on Uniform State Laws Consider Proposed Federal and State Aeronautical Laws

For the first time in the history of American aeronautics, a joint meeting of subcommittees representing the American Bar Association and the Commissioners on Uniform State Laws was held in Washington, on Feb. 25, at which Army, Naval and civil aeronautical experts presented their views on proposed federal and state aeronautical laws. This also acted for the comparison and support of these laws great legal organizations in the enactment of legislation for the development of aviation.

Favorable to B. Edwards, Bell

While the joint conference took no action, it was developed on the segment of the session that the Watersbury Bill (H.R. 3876) for Federal control of interstate commerce in the air be postponed, and that no specific legislation be recommended to the states that would in any way conflict with the idea of absolutely uniform regulation of air navigation. Aviation officials and aeronautical experts have held several conferences on the subject of national and state aviation laws, but the session held recently was the first time they have held an opportunity to meet with legal experts and state representatives.

Two major problems are considered. First, the speed of Wakefield-Hike BDL establishment is hampered by Civil Aviation in the Department of Commerce to suggest aircraft, license operators, regulate navigation and expenditure of civil aircraft, designate air routes, recommend the establishment of air stations, furnish meteorological services, and study and develop aviation in general and, second, the examination of a tentative draft of a proposed statute only less proposed by the Department of Commerce, the Council on Aeronautics and Astronautics, the Federal Bureau of Investigation, the Chairman of the Committee on Aviation of the Transportation Committee on Uniform Laws.

Theresa R. Betancourt

[illegible]

Active General Asset Register

Seeking new sort of action, known as a writ, against Admiral Hopper and that while lawyers disagreed as to the constitutionality of aerial laws, he hoped that we could secure enactment of Federal law, as an experiment at least, and he asserted that the Supreme Court would settle whether it was constitutional. He pointed out the need of aerial law and cited as an example what a nuisance automobile traffic and the highways around would be in without law.

General Palmer urged the support of the Wadsworth Bill and said that in his opinion no legislation should be revised.

needed to the individual states that might in any way conflict or interfere with Federal regulations when they are promulgated.

All the citizens and individuals were asked to express their opinions on the subjects before the panel session by Clarence McCracken, who presided. A general discussion followed, without opinion advocating a rule and state policy setting before the state the necessity of only the simplest form of state legislation which should deal with fundamental matters of sovereignty and ownership of the sea, and be otherwise helpful in creating without group into details of regulation and freedom.

The question of the constitutionality of previously proposed details of Federal legislation was discussed at length, and a number of speakers urged the assembly, at a coming national conference, to urge the Federal Government to bring arrangements for the arm and munition control and all aerial navigation in the United States. The discussion disclosed, however, that the pending Wadsworth bill was clearly unconstitutional. It was also evident from the discussion that the conference will revise the proposed uniform state aerial law incorporating the suggestions made.

Exhibits at Aircraft Owners'

The liability of owners and operators of aircraft for damage to property on the ground was also discussed. On this question the draft submitted by Dr. Rupert undertakes to hold the owner and operator of aircraft liable for damage to all third persons and their property. Under the common law, it was pointed out, an operator of an airplane or other aircraft would be liable to a reasonable degree, and that in respect the law in this direction would be not only more uniform, but if psychological effort would be to place one more building on an airless development.

[illegible]

It was concluded that each of the subcommittees will report to its respective organization, and that these bodies will make appropriate recommendations to the mother.

A. and D. R. Black

Owing to the slow development of commercial aviation, upon which "outside" engineers are largely dependent, A. & D. E. Black Consulting Engineers recently closed their New York office. They hope, however, that this will prove to be only a temporary setback.

In the meantime their services, as individuals, will continue to be available, although they will have no staff. Their new address is Garden City, N. Y.

Improvements in Aircraft Power Plants

Engines Should Embody Even Greater Lightness and Compactness Than Today, and Obtain Them without Sacrifice in Reliability

By R. J. Dolph

When we look back over a period of just a very few years and consider the present development of the universal combustion engine, as it is now applied to the airplane, we cannot but be amazed at the wonderful improvement which has taken place, although we have not realized it from year to year. The change has come gradually and the present results have been gained through a gradual refinement in design, material and workmanship, there being no radical changes in the fundamental mechanical principles from the first successful automobile engine to the present type of refined aviation engine.

The Present Situation

Our best six-cylinder engines of today are truly wonderful machines when compared with the engines of a few years ago, and when we consider their fuel economy, piston speeds of 3000 ft. with 2800 rpm., and their ability to consistently and reliably perform under varying conditions for from 200 to 300 k., they surely are a tribute to their designers.

There have been today rather changes in plans, drops in equipment by a wonderful increase in performance allowed, may one comprehensible amount of this increased action to the present stage of perfection of the engines. But notwithstanding the wonderful performance of the latest engines, which were to have well kept engines, protection, and although the plans themselves after plenty of time for refinement in the design of the engine, a great deal of time has been devoted to the higher efficiency, and finally, the number drops such as engine and fuel systems, maintenance account of their efficiency, weight and overall dimensions.

Although throughput of 1.5 to 2.5 lb per hp seems only remarkable when one recalls the efforts of designers of a few years ago, the requirements of future performance will be even greater. Lightness and compactness, which can be obtained without loss of effect of reliability or endurance but should be accompanied by a corresponding increase of mass.

The Development of Encumbrance

The overall dimensions of the present engine are a direct result of the further refinement of the boreline, especially at the average speed condition, at the foretrot portion of the body and deposit into the head environment design in order to have the engine. If the proper form is maintained, it will be more-or-less large, as portions of the engine must be left exposed, either of which naturally affects the protrusion with a corresponding decrease in the efficiency of the design.

The large, well-maintained meadows with open-air pavilions are also affected in the same way, although possibly to a lesser extent. A percentage of the total performance, but not the total performance, is lost. The loss of the meadows' direct contribution would also tend to reduce the displacement of large, private cars, which would not drive the land reservation with its technology to open new communities and commercial spaces in unfilled urban places. The loss should also be viewed in the context of the loss of the meadows' and some of the weight per horsepower, which probably be compensated by an increase in engine efficiency. All of this would tend to increase the range and efficiency

With the present *faustage* designs, the radiator or exhaust cylinder is of the conventional six, eight or twelve cylinder type. Such exhaust to the air, offer a high heat resistance and form a considerable percentage of the power necessary for the penetration of the *faustage*. This unnecessary resistance is becoming more and more important as development advances, owing to the high speeds which designers are striving for and which must be realized as it is the greatest asset of the commercial engine.

As an interesting aside to forward motion, most aircraft are "overpowered" by design speed in some portion of their flight envelope. This means that at either of which some shorter range or greater fuel economy and consequently less pay load. This is a direct blow to the efficiency we are striving for and to the commercial success. Any unnecessary weight of the power plant also directly affects the speed, especially in climbing, and consequently the range or fuel load and in turn the pay load of the commercial carrier. The most direct result of these facts is that the very fact of a large engine of operation can be obtained by a direct comparison of the cost of the engine with the cost of the power plant of some of the articles published lately, giving the speed and performance of some of the latest aircraft (all commercial aircraft).

A reduction in weight and overall dimensions which add greatly to the compactness of the power plant, also contributes in a great measure to the maneuverability of the airplane which is greatly desired in military machines, especially of the current type.

Return to [Stacy's Engineering](#)

One of the main advantages of the rotary type of engine in the smaller sizes has been their lightness and compactness due to their special design, and being especially adapted for air cooling. However, with the demands for greater power these engines had to give way to the "V" type an account of their low fuel oil speed and economically efficiency in power. Also in the larger sizes their gyroscopic effect is detrimental to stability in operation, and they are subject to vibration with consequent head problems. The radial engine has the considerable merits and both the rotary and the V engines have, in these larger sizes an account of their extended leveling dimensions, the twisting effects of very long complicated valvetrain and exhaust systems.

Considering programs of average size, the requirements for lightness, compactness, and versatility seem to be met best by the cast alloy γ -Ti, except as it is somewhat shorter than the vertical size of γ -Ti (due to shorter cross-shells, end shells, end caps and exhaust systems and three free screws than adjacent disadvantages and trading for a more compact installation.

Regarding the overall dimensions, the present design is a symmetrical valve gear mechanism, a large percentage to the height of the cylinder. Although the valve is the least construction with overhead cam shafts seems to be the most efficient arrangement to spread the combustion chamber design location at multiple valves with their simplest operation mechanism, direction and length of gas passages, etc., it adds greatly to the overall height of the engine and its overall dimensions and space of construction on account of the valve train. The valve drive mechanism is a gas passage mechanism, direct line steel, various air passages, their height

Reductive Design

Another important stress considering future aviation power plants is the conventional forms of radiators. The same radiators, although not the most efficient for cooling, present other advantages as to ease of mounting, nonvibrancy, air requirement at pressure, etc. But the forms of radiators in a minimum use other advantages and the designers have to be considered. The second kind of resistance is connected with the work accomplished. The power plant itself has a very efficient engine but when the engine, thrust of the radiator having a high load resistance is introduced from this, instead of added to the resistance of the plane as a generally done. The total efficiency of the power plant is reduced and the engine is not used to its full capacity. The same situation can exist, but here stress and resistance

Aeronautical Briefs

Flying to the Farthest North.—Pilot Martin and Captain Maxwell, flying an airplane equipped with runners in place of wheels for the "take off," recently completed a successful trip from Cochrane, Ont., the northern rail outpost, to Moose Factory, on the south shore of the Hudson Bay, and return. The airplane, carrying mail and supplies weighing 200 lb., left Cochrane at four o'clock in the afternoon and two hours and ten minutes later, with one stop, arrived safely at Moose Factory.

On the return trip three landings were made on the Ahitihiti river to test the machine with different snow conditions. The ski attachments, Captain Maxwell reported, were found to be practical, his ship landing and taking off with the ease of a flying boat on open water.

Fast Flying between Washington and Dayton.—What is considered a record non-stop flight between Dayton, Ohio, and Washington, D. C., was made by Lient. C. V. Haynes, Air Service, on Feb. 4, in a special DH4B Messenger ship, the trip consuming 2 hr. 55 min. The distance between Washington and Dayton is 440 miles, making the rate of speed traveled by this plane slightly in excess of 147 m.p.h.

Federal Air Legislation.—The Wadsworth-Hicks bill, which passed the Senate on Feb. 14, is now before the House Committee on Interstate and Foreign Commerce.

Airplane Crosses Atlas Mountains.—For the first time, a commercial airplane has flown across the Atlas Mountains in Morocco, according to a message received at the London Air Station. The Atlas range is 15,000 ft. high. The pilot was Alan J. Cohnan, an English aviator.

Safety of British Air Lines.—Not one passenger has been killed, or even seriously injured, in a British civil airplane throughout 1921, although during the summer between four hundred and five hundred people a week were crossing the Channel by air, and although well over one thousand a week were being taken up for joy rides. Credit for this showing goes not only to the skill of the pilots and airplane mechanics but also to the aeronautical inspection department and the controller of airdromes and licenses, who have made sure that only first-class men and machines have been allowed to carry passengers.

Aerial Photography and Ethnology.—For the first time, an American archaeologist has used aerial photography to obtain bird's-eye views of the oldest man-made topographical features of America, the Indian mounds. David I. Bushnell, Jr., is using such photographs of the mounds near East St. Louis to illustrate a report of the bureau of ethnology of the Smithsonian institution at Washington.

Airplane Assists Bank.—An airplane laden with sufficient money to pay all depositors of a bank at El Dorado, Ark., was recently dispatched from Shreveport, La.

The airplane was sent off following a run on the bank due to a false report that it was insolvent.

Air Taxi for American Tourists.—A regular taxiplane service for the benefit of passengers on trans-Atlantic liners will begin at Liverpool and at Southampton before the annual Spring rush of tourist travel from the United States sets in. Passengers will be able to wireless a central airport in London from sea and order a plane to meet them at the ship in Southampton or Liverpool. The planes will deliver passengers to any point in the British Isles or on the Continent.

Canadian Activities.—A Martinside airplane piloted by Major Cotton will be used this spring in Canada in connection with the seal hunt. She will act as a scout, reporting the location of the herds to steamers.

While portions of the Newfoundland Railway have been tied up by ice and snow, recently, the airplane has been carrying mails and passengers from St. John's to various other towns. The machine has also been used to carry provisions to ships caught in the ice.

Buenos Aires-Montevideo Air Line.—A regular airplane passenger service between Buenos Aires and Montevideo has recently been started and hereafter two round trips will be made weekly, in addition to other air voyages of special urgency. On the first trip four passengers and a quantity of correspondence were transported.

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